CHAPTER 7

ORAL PHARMACOLOGY

Pharmacology is a basic medical science that deals with the study of drugs. Drugs are chemical compounds used in the prevention, diagnosis, and treatment of diseases and other abnormal conditions. This chapter covers some of the drugs used in dentistry.

As a Dental Technician, you will be required to assist in procuring, labeling, and storing drugs. You must also be aware of what drugs the dental officer prescribes and uses during dental procedures. Certain drugs and medicines used in dentistry have side effects on patients, which could turn into a possible medical emergency. Misused or mislabeled drugs can also present a real hazard to your patient's safety. You must have full knowledge of what drugs and medicines are being used in your clinic, hospital, or department. Only authorized personnel should prescribe, dispense, and administer drugs and medications. The *Manual of the Medical Department*, chapter 21, gives guidance on pharmacy operation and drug control.

DRUG STANDARDS

Many textbooks are available that describe commercially available drugs used in dentistry and medicine. They provide standards for drugs of therapeutic usefulness and pharmaceutical necessity, and also list composition, action and use, administration and dosage, precautions and side effects, dosage forms available, and common (generic) name of the drugs. Your command library is required to have these textbooks available for use.

MEDICATION AND ADMINISTRATION

The quantity of a drug to be prescribed at one time or the total quantity administered and method of administration of drugs are dependent on several factors. This section will cover some of the methods of administering and some of the factors affecting dosage calculations that a dental officer will use.

DOSAGE

The amount of medication to be administrated is referred to as dose. Doses are listed as an average therapeutic dose and are known as "usual adult doses." The following terms are used in connection with doses.

Therapeutic Dose

The therapeutic dose is also referred to as the normal adult dose, the usual dose, or average dose. It is the amount needed to produce the desired therapeutic effect.

Dosage Range

Dosage range is a term that applies to the range between the **MINIMUM** amount of drug and the **MAXIMUM** amount of drug required to produce the desired effect. Many drugs, such as antibiotics, require large initial doses that are later tapered to smaller amounts. A **TOXIC** dose is the amount of drug that will produce symptoms of poisoning; while a **MINIMUM LETHAL** dose is the least amount of drug that can produce death.

FACTORS AFFECTING DOSAGE

With the administration of medicines used in dentistry, the dental officer must consider many factors with each patient that affects the dose, method of administration, and frequency of the dose. Although a dental officer prescribes or administers the amount to be given, you need to know how and why these quantities are determined. Two primary factors determine or influence the dose: age and weight.

Age

Age is the most common factor that influences the amount of a drug to be given. Infants, children, and elderly patients are more susceptible to drug action and as a general rule, should receive smaller doses than others.

Weight

In the calculation of dosages, weight has a more direct bearing on the dose than any other factor, especially in the calculation of pediatric doses.

METHODS OF ADMINISTRATION

In dentistry, drugs are introduced into the body by different routes, each serving a specific purpose. We will cover parenteral, oral, inhalation, and topical administration of drugs next.

Parenteral

Parenteral medications are those introduced by injection. All drugs used by this route must be pure and sterile. Always check the solution to ensure it has not expired and is clear in color. Several types of parenteral administration can be used in dentistry.

- Intravenous—The drug is introduced directly into the vein. Example: Intravenous sedation. Guidance to dental treatment facilities for the administration of outpatient anesthesia services in intravenous (IV) sedation to dental patients can be found in BUMEDINST 6710.67.

- Infiltration—This method that is commonly used to anesthetize maxillary teeth. The dental needle and anesthetic are placed into the mucosa along the side of the tooth (facial aspect) and alveolus that is being treated. This technique is possible because the porous composition of alveolus cancellous bone allows the anesthetic to soak through the bone and anesthetizes the apices of the teeth. It is also used in procedures such as biopsy, gingivectomy, frenectomy, and the excision of abnormal tissue.

- Block—Because the mandibular bone is very dense, infiltration techniques cannot always be used to achieve adequate anesthesia. A block technique is the most effective means to achieve anesthesia of the mandibular teeth. A dentist will use various types of blocks to anesthetize specific areas. When performing a block technique, the dentist will place the needle and anesthetic into the mucosa and aim them near a specific nerve where the solution is deposited. The area of the nerve is blocked and all surrounding areas the nerve branches off to are also anesthetized. When a **mandibular block** (inferior alveolar nerve block) is performed, the patient will experience anesthesia on half of the mandible, including the teeth and lower lip.

- Periodontal ligament injection—If this procedure is needed, it can be used instead of an infiltration injection. The needle and anesthetic are placed directly into the periodontal ligament along the side of the tooth, where the solution is deposited under pressure. This injection is very painful.

Oral

Oral administration of medications comes in the form of tablets, capsules, liquids, and suspensions. Dental patients may receive medications by this method preoperatively (before) or postoperatively (after) a dental procedure. Another route closely associated with oral administration is **SUBLINGUAL.** The drug is placed under the tongue and is rapidly absorbed directly into the blood stream. An example is nitroglycerin sublingual tablets.

Inhalation

Inhalation is the introduction of medication through the respiratory system in the form of a gas, vapor, spray, or powder. The three major types are vaporization, nebulization, and gas inhalation. The most common type of gas inhalation used in dentistry is nitrous oxide sedation and will be discussed later in the chapter.

Topical

Topical agents are applied to a particular surface area of the skin being treated. Examples of topical agents are ointments, creams, lotions, shampoos, paste, gels, and liquids. Dental topical agents will be discussed in this chapter under anesthetics.

DRUG CLASSIFICATIONS

The definition of a drug is any chemical substance that has an effect on living tissue but is not used for food. Drugs are used on or administered to humans or animals as an aid in the diagnosis, treatment, or prevention of disease or other abnormal conditions, for the relief of pain or suffering, or to control or improve any physiological or pathological condition. A drug may be classified in various categories, depending upon different criteria. Examples are general, chemical, and therapeutic.

- General—Drugs are grouped according to their source, whether animal, vegetable, or mineral in composition.

- Chemical—Medications are grouped by their chemical characteristics. Examples are acids, bases, or salts.

- Therapeutic (Pharmacological)—Drugs are classified according to their action on the body. A drug may have more than one action.

The drug classifications can be further divided into two groups: noncontrolled and controlled drugs.

Noncontrolled Drugs

Noncontrolled drugs are referred to as non-prescription, over the counter drugs (OTC), (i.e., aspirin, and mild analgesics). These drugs are effective for relieving most mild dental pain.

Controlled Drugs

All prescription drugs are to be treated with respect; certain groups considered to have a potential for abuse, such as narcotics, stimulants, and sedatives require special handling and security measures. Controlled substances are those drugs listed in the Controlled Substance Act of 1970 that is administered by the Drug Enforcement Administration (DEA) of the Justice Department. Controlled drugs are categorized into five schedules. MANMED, chapter 21, describes the schedules. Ethyl alcohol (used to fuel laboratory torches), although not included in any schedules of the Controlled Substances Act, must be received and accounted for, and dispensed in the same manner as schedule II substances described in MANMED, chapter 21.

DRUG NOMENCLATURE

The term *drug nomenclature* implies that there are several names that can be used to identify a drug. Normally drugs have three names: chemical, generic, and trade (brand).

- Chemical name—Describes the chemical and molecular structure. The chemical name of a common dental local anesthetic called acetamide is 2-(diethylamino)-N-(2,6-dimethylphenyl)-monohydro chloride ($C_{14}H_{22}N_2O.HCL.H_2O$).
- Generic name—Describes the common name of the drug. The above example has the generic name of lidocaine hydrochloride.
- Trade name—This name is given by the manufacturer, and is also called the brand name.

DRUGS USED IN DENTISTRY

The drugs listed here are some of those commonly used in dentistry and are grouped according to pharmacological classes. Only a brief summary is possible here and the Dental Technician who desires more complete study of each drug should refer to reference books in the command library.

ACIDS

Acids are very caustic and present a sour taste. Extreme care must be taken when handling acidic substances. Follow all safety precautions on Material Safety Data Sheets (MSDS) for each product. A common acid used in dentistry is phosphoric acid, and comes in the forms of solutions or gels. It can be used in etching procedures with composite restorations, sealants, and orthodontic brackets.

EMOLLIENTS

Emollients are bland or fatty substances that may be applied to the skin to make it more pliable and soft, and can also serve as a lubricant in dental procedures.

Cocoa Butter (Theobroma Oil)

Cocoa butter is an excel lent emollient with a pleasant odor. It is ideal for the treatment of chapped or cracked lips, and can also be used as a lubricant in rubber dam procedures.

Petrolatum (Petroleum Jelly)

Petrolatum is highly occlusive and a good emollient. It can be used as a lubricant when handling sticky dental materials, and has several uses in the prosthetic laboratory.

DISINFECTANTS, ANTISEPTICS, AND GERMICIDES

These drugs and chemicals are primarily intended for the prevention of infections by destroying microorganisms or preventing their growth. The differences among them are based primarily on the degree of activity and how they are used. Complete details on their uses is covered in chapter 10, “Sterilization and Disinfection.”

ANTIBIOTICS

Antibiotics are chemical compounds that stop the growth of or destroy different types of bacteria and other micro-organisms. They are used in dentistry to treat oral infections. They are also prescribed as a

prophylactic (ward off disease) measure to prevent infective endocarditis (or IE) and in other medical conditions. Patients having history of infective endocarditis, rheumatic heart disease, artificial heart valves, and some heart murmurs are at high risk when involved in dental procedures that are likely to cause bleeding. They are prescribed a large dose of antibiotics before treatment and a smaller dose 6 hours after the initial dose. In all cases the dental officer will review the patient's health history and will prescribe an antibiotic if needed. Many types of antibiotics are available; listed are a few groups that are used.

Penicillin

Penicillin is one of the most important of the antibiotics. It is derived from a number of *Penicillium* molds commonly found on breads and fruits. It is one of the most effective and least toxic of the antimicrobial agents used in dentistry.

Cephalosporins

Cephalosporins are a group of antibiotics that are structurally and pharmacologically related to the penicillin. Because the cephalosporins are structurally similar to pencillians, some patients who are allergic to penicillin may be allergic to a cephalosporin drug. So, special caution is necessary when taking cephalosporins.

Tetracyclines

The tetracyclines, introduced in 1948, were the first truly broad-spectrum antibiotics. Administration to children and pregnant women is not indicated because it may produce discoloration of the teeth and slow bone marrow growth.

Erythromycin

Erythromycin has a bitter taste and is destroyed by gastric acids, and usually comes in the form of a coated tablet. Erythromycin is one of the drugs of choice when penicillin is contraindicated. Many patients cannot tolerate the nausea and stomach upset commonly associated with erythromycin, so the dentist may have to prescribe an alternate drug.

NON-NARCOTIC ANALGESICS AND ANTIPYRETICS

Analgesics are drugs that relieve pain without producing unconsciousness or impairing mental capacities. Many of these drugs also have an antipyretic and/or an anti-inflammatory effect. Antipyretics are drugs that lower increased body temperatures. Analgesics can be used to relieve pain from toothache, or can be prescribed for dental postoperative pain relief.

Aspirin

Aspirin is an economical analgesic, antipyretic, and anti-inflammatory agent used for mild to moderate pain. It is contraindicated in peptic ulcer disease. It acts as a gastric mucosal irritant and has an anticoagulant (inhibits blood clotting) effect.

Acetaminophen

This drug is similar to aspirin, but has no anti-inflammatory action. It is available as tablets, elixir, drops, or capsules and is useful for patients who are sensitive to aspirin.

Ibuprofen

Ibuprofen is indicated for the relief of mild to moderate pain. It is used as an anti-inflammatory agent for dental pain associated from post surgical or operative procedures. It is not to be given to patients in the third trimester of pregnancy or anyone with a history of gastrointestinal bleeding.

OPIUM AND ALKALOIDS

Alkaloid-based compound names end in *-ine.* Examples include atropine, caffeine, and nicotine. The most important alkaloids of opium are morphine and codeine. All of the opiate derivative drugs are very addictive and require strict control.

Morphine Sulfate

Morphine sulfate is a drug indicated for the relief of severe pain and used preoperatively to sedate patients, treat myocardial infarctions, and is used in casualty care. It is contraindicated in patients with head injuries, acute alcoholism, or convulsive disorders.

Codeine Sulfate

Codeine sulfate is like morphine, but has one-sixth of the analgesic power and one-fourth of the respiratory depressant of morphine. It is used as a pain reliever in dentistry for moderate to severe dental pain.

Meperidine Hydrochloride (Demerol)

This is a synthetic analgesic similar to morphine. In dentistry it is used for moderate to severe pain and as a preoperative medication.

VASODILATORS

These drugs produce vasodilation by relaxing and enlarging the diameter of the blood vessels and smooth muscle of the arteries, thereby lowering the blood pressure.

Amyl Nitrite

Amy1 nitrite is primarily used in casualty care to treat blood agents. This will be discussed in chapter 13. Other uses are for urological conditions.

Nitroglycerin

Nitroglycerin is indicated for the treatment and management of acute and chronic angina pectoris. Administration of this drug will be discussed *in Dental Technician, Volume 2, NAVEDTRA 12.573, chapter 9.*

VASOCONSTRICTORS

Vacoconstrictors are the opposite of vasodilators; these drugs produce constriction of the blood vessels with consequent rise in blood pressure. In dentistry, epinephrine is used in some dental anesthetics, rarely in gingival retraction cord processes, to help control diffuse bleeding, and can be used to treat severe allergic reactions, such as anaphylactic shock. In local anesthetics, small amounts of epinephrine are added in dental carpules, with ratios ranging from: 1:50,000, 1:100,000, or 1:200,000 parts of epinephrine to anesthetic solutions.

HEMOSTATICS

Hemostatics are any agents, mechanical or chemical, that arrest bleeding. They are used to control hemorrhage from minute vessels or tissues by stopping bleeding or by forming of a clot. Examples of mechanical and chemical agents will be discussed in *Dental Technician,* Volume 2, NAVEDTRA 12573, chapter 5, "Oral Surgery Assistance."

ANTICOAGULANTS

This group of drugs delays or prevents blood coagulation. A common anticoagulant used in dental I.V. sedation is heparin sodium.

ANESTHETICS

The word *anesthesia* means a partial or total absence of sensation to stimuli, such as cold, heat, or painful irritation. In dentistry the words numb, frozen, or asleep are examples of how the mouth can feel when the anesthetic is administered. Dental anesthesia comes in many forms such as gas, local, and topical to control pain and relax patients.

Nitrous Oxide

Control of anxiety and pain associated with dental care can be accomplished by administering local anesthesia and sedation. The most commonly used gas in dentistry is nitrous oxide sedation. It may produce a condition where the patient may laugh and become quite talkative. Nitrous oxide is supplied in blue steel tanks. Inhalation sedation with a mixture of 40% nitrous oxide and 60% oxygen (N20-02), delivered through a gas machine produces a conscious sedation that is a safe and effective means to manage the behavior, anxiety, and pain of many dental patients before and during a dental procedure. The advantages of N_2O-O_2 sedation are:

- Rapid onset of action.
- Good control of the depth of the sedation.
- Rapid and complete recovery.

Guidance to dental treatment facilities for the administration of nitrous oxide-oxygen (N_2O-O_2) inhalation conscious sedation for dental outpatient services can be found in BUMEDINST 6710.68.

Local Anesthetics

Most dental procedures require cutting or painful manipulation of living tissue. To make these procedures comfortable for the patient, the dental officer will inject local anesthetic agents for pain control. Local anesthetics temporarily prevent the conduction of sensory impulses such as pain, touch, and thermal change from a body part along nerve pathways to the brain. The dental officer can select regions of the mouth he would like to lose sensation to complete the dental procedure. About 15 different local anesthetics are available for dental use. These anesthetic solutions can be chemically classified into two different categories: amides and esters.

- **Amides**—An organic compound that comes from ammonia. Examples of amide solutions are lidocaine, bupivacaine, and mepivacaine.

- **Esters**—Are compounds formed from alcohols and acids by the removal of water. Ester compounds are rarely used in dentistry today. Examples of ester solutions are procaine and propoxycaine.

The two most common local anesthetics used in dentistry today are 2% lidocaine hydrochloride and 2% mepivacaine. Both solutions take effect quickly, and provide a complete anesthetic effect of the dental pulp, tissues, and surrounding bone for up to 90 minutes. The use of vasoconstrictors with local anesthetics has been discussed earlier. Both lidocaine and mepivacaine are available with or without epinephrine.

Topical Anesthetics

In dentistry topical anesthetic agents are used to temporarily anesthetize (numb) the tiny nerve endings located on the surfaces of the oral mucosa. This can reduce the discomfort of dental injections and eliminate the gag reflex when performing radiographic, periodontal, and prosthetic impression procedures. You must be aware that the concentration of topical anesthetic solutions are much higher than injectable anesthetics. Also topical anesthetics take longer for the full effect compared to injectable anesthetics. One to five minutes after application is the recommended time for topical anesthetics to reach their full effectiveness. Whenever you are using topical anesthetics, you must have permission from the dental officer. Follow all safety precautions and manufacturer's instructions. The three most commonly used topical anesthetics in dentistry are ointments, sprays, and liquids.

OINTMENT TOPICAL ANESTHETICS.—You may be asked by the dental officer to place an ointment topical anesthetic at an injection site before injection of dental anesthesia. Always follow the manufacturer's instructions before use. To start this procedure, take a sterile 2-inch × 2-inch gauze and gently wipe and dry the area of the mucosa where the topical anesthetic is to be placed. Next take a sterile cotton tipped applicator and open the container and place a small amount of the ointment on it. Always use a sterile applicator each time you use the ointment to prevent contamination and replace the cover when not in use. Place the cotton portion of the applicator with the ointment on the area to be anesthetized. Patients must be told NOT to swallow any of the anesthetic. Have the saliva ejector or high-speed evacuator (HVE) standing by to remove any fluids the patient may have accumulated while the topical anesthetic is taking effect. After the dental officer has completely anesthetized the patient, use the 3-way syringe and HVE to rinse the patient's mouth completely, paying attention to the area where the topical anesthetic and anesthesia have been placed and injected.

TOPICAL DENTAL SPRAY.—The use of topical dental sprays is an effective means to assist patients, who may have an exagerated gag reflex to complete dental procedures. Always consult with a dental officer, when treating a patient who has a gag reflex. It may even be documented on his/her health history form. Use of lidocaine spray in some cardiac patients or children could cause problems. Certain patients are very sensitive to any objects placed in the oral cavity, especially posterior X-rays, and prosthetic impressions. Special care and time must be given to these patients to ensure the patient does not have a bad experience, such as gagging or vomiting, during the procedure. The time you spend to make your patient comfortable will benefit your patient and the quality of the procedure you are doing. When using a topical spray, follow the directions the dental officer will give you, along with the manufacturer's instructions.

LIQUID TOPICAL ANESTHETICS.—Liquid topical anesthetic come in the form of a viscous (thick) liquid. They produce the same effect as spray topical anesthetics by numbing the oral mucosa and the mouth, but in addition can be used to gargle to anesthetize the pharynx. Under the direction of a dental officer, the patient takes the liquid and swishes it around in the mouth, which is removed by a saliva ejector HVE or by spitting. It is useful for patients who need to be anesthetized for gag reflexes when taking prosthetic impressions or dental radiographs. In addition the dental officer may prescribe liquid topical anesthetics to patients for the temporary relief of pain from ulcers, wounds, and periodontal treatment in the mouth.

Miscellaneous Drugs

Numerous other drugs are used in dentistry. Some drugs, for example, are used as antisialagogues. Such drugs as atropine sulfate, scopolamine hydrobromide, and methantheline bromide reduce a patient's salivary flow, thereby providing a drier field of operation. Other drugs are used in specialized areas of dentistry and will be discussed, where appropriate, in later chapters.

PROCURING DRUGS

For a patient to receive drugs, both controlled and noncontrolled, the dental officer will use the DOD Prescription (DD 1289) or Polyprescription

(NAVMED 6710/6). Many dental treatment facilities, are able to prescribe drugs and medications through an automated pharmacy system (computerized). This saves the patient valuable time by not having to stand in line and wait for prescriptions. All drugs prescribed are to be documented by the dentist in the patient's Dental Health Record on the SF 603/603A. Instructions for preparation of outpatient prescriptions and automated pharmacy procedures can be found in the MANMED, chapter 21.

LABELING DRUGS

Most drugs for direct patient use have cautions or warnings preprinted on the label warning the user of hazards of handling involved. When no label is on a drug, you must clearly place a label indicating its name, proper warnings, and its strength. Powerful and dangerous drugs require special labeling. The information on these special labels should be typed or printed in **RED** with the caution warning above the name. Listed below are examples of cautions you might encounter.

- **POISON**
- **CAUSTIC**
- **FLAMMABLE/VOLATILE**

It is your responsibility to know every precaution of use, handling, and storage for each drug or chemical you come in contact with for the safety of yourself and your patient.